F5

(12) UK Patent Application (19) GB (11) 2 254 255 (13) A

(43) Date of A publication 07.10.1992

(21) Application No 9206761.0

(22) Date of filing 27.03.1992

(30) Priority data
(31) 03089763 (32) 28.03.1991 (33) JP

(71) Applicant
Kao Corporation

(Incorporated in Japan)

14-10 Nihonbashi-Kayabacho, 1-Chome Chuo-Ku, Tokyo, Japan

(72) Inventors
Norihiro Abe
Tsuyoshi Konno
Junko Nagasawa
Yoshihiro Sakai

(74) Agent and/or Address for Service
Kilburn & Strode
30 John Street, London, WC1N 2DD, United Kingdom

(51) INT CL⁵
A61F 13/48

(52) UK CL (Edition K)
A5R RPG RPR

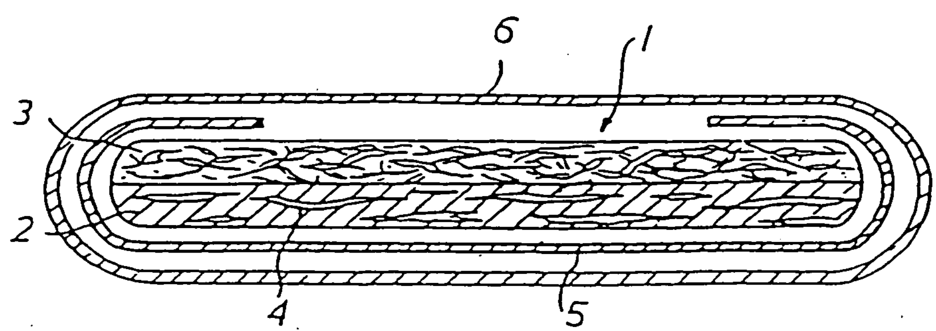
(56) Documents cited
GB 2208477 A GB 2165757 A

(58) Field of search
UK CL (Edition K) A5R RPG RPL RPR
INT CL⁵ A61F

(54) **Absorbent sanitary article**

(57) An absorbent article, such as a sanitary napkin or disposable diaper, comprises a liquid permeable top sheet (6), a liquid impermeable bottom sheet (5) and an absorbent element 1 interposed between them. The absorbent element comprises two layers of fibrous material, the first absorbent layer (2) close to the bottom sheet having a higher density than the second absorbent layer (3) close to the top sheet. The first absorbent layer (2) has a plurality of layers of cavities (4) distributed over its entire thickness, the area occupied by the cavities amounting to 45 to 80% of the cross-sectional area.

FIG.2



Best Available Copy

GB 2 254 255 A

FIG.1

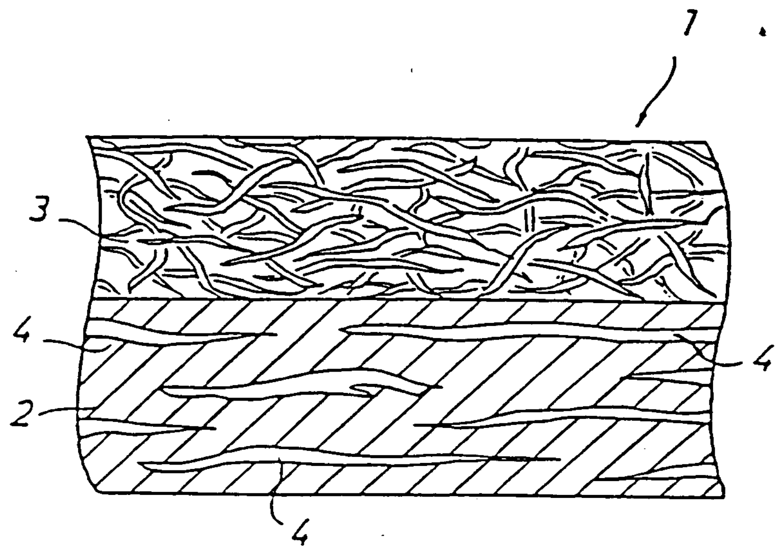


FIG.2

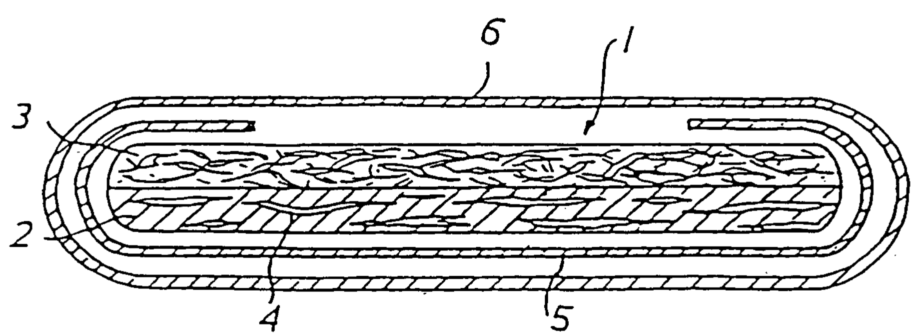


FIG.3

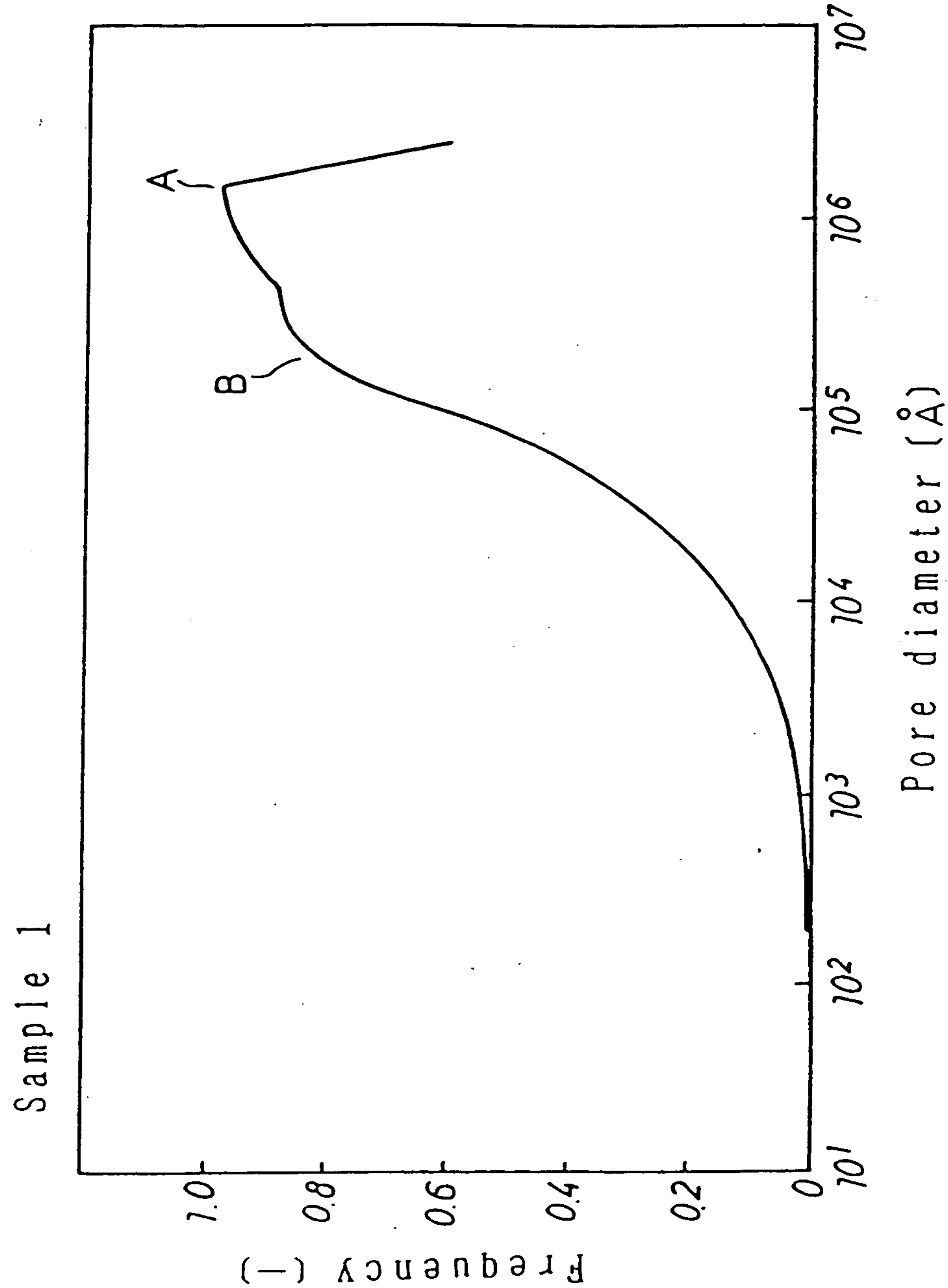

Sample 1
A
B
Frequency (−)
1.0
0.8
0.6
0.4
0.2
0
10^1
10^2
10^3
10^4
10^5
10^6
10^7
Pore diameter (Å)

FIG.4

Sample 5

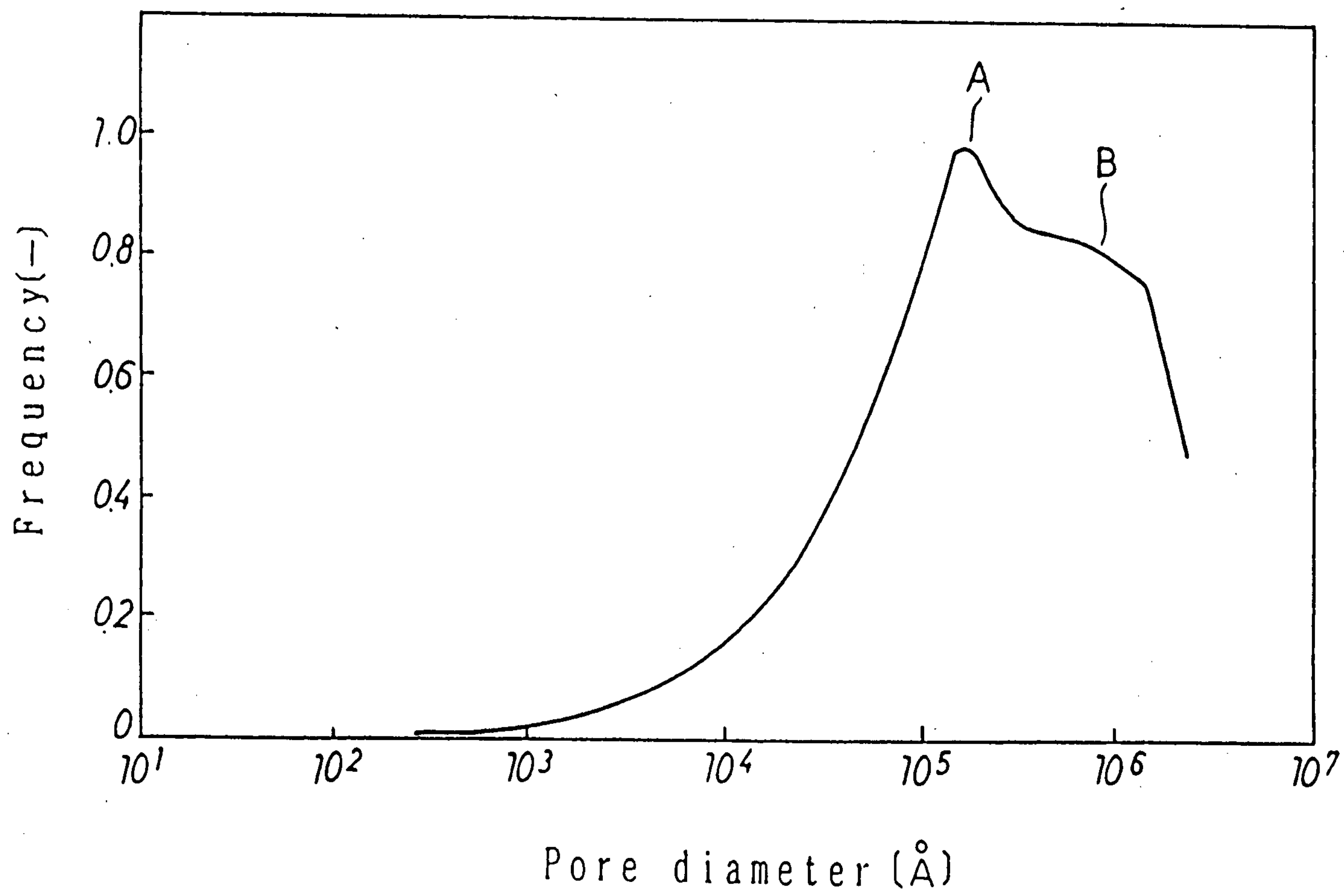
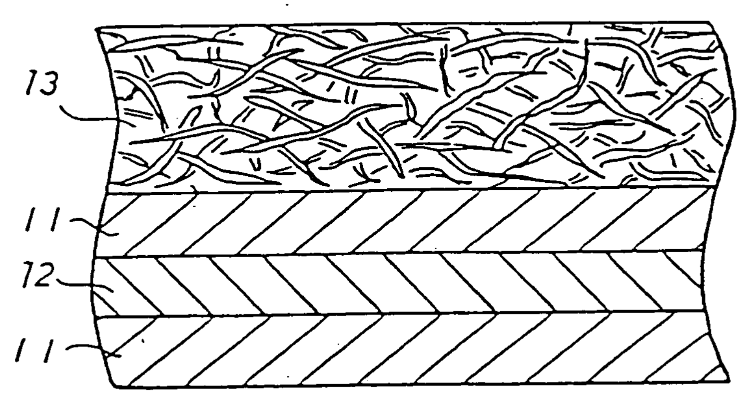


FIG.5



ABSORBENT ARTICLES

The present invention relates to absorbent articles, such as sanitary napkins and disposable diapers, and is concerned with improving the liquid absorptivity and retentivity of such articles.

Various absorbent articles have been proposed which include an absorbent element whose absorption characteristics are retained when the element is compressed.

Japanese Patent Laid-Open Specification No.123597/1977 discloses an absorbent element having the structure illustrated in Figure 5, which is a diagrammatic cross-sectional view. This absorbent element comprises two absorbent layers 11 having a thickness of 1 to 4 mm prepared by compressing a fluffy pulp at a compression ratio of 1/10 to 3/100, a layer of absorbent paper being interposed between the absorbent layers 11 and a fluffy fibrous layer 13 being placed thereon to form a laminate.

Japanese Patent Laid-Open Specification No.152694/1977 discloses a sanitary napkin, the entire hem of which is bonded and which has a laminated structure comprising a main pad having a compressed centre and an auxiliary pad having a compressed density lower than that of the main pad. It is stated therein that only the centre of the napkin is compressed in its longitudinal direction so as to smoothly absorb the menstrual blood and to maintain the surface dry for a long time.

However, in the former specification wherein a fluffy fibrous layer is formed on the pulp layer, the fluffy fibres must be easily wettable by the liquid and maintain openings for the passage of the liquid even when it is wet in order that the fluffy fibrous layer on the pulp layer rapidly absorbs the liquid.

In the latter specification, the condition and degree of the compression are not clearly described. It is presumed from the drawings attached to the specification that the degree of compression is about 1/2, which is insufficient for the smooth absorption of menstrual blood. If it is presumed that the central part of the napkin is highly compressed in order to increase its absorption efficiency, the pores in the fibrous material must be very small and capillary passages must be formed and, consequently, the rate of transfer of menstrual blood is seriously reduced and when the blood is viscous, the fibres will be blocked with blood thereby making efficient absorption impossible. In addition, the absorbent element is stiffened by the excessive compression thereby making it uncomfortable for the user to wear the napkin.

The absorbent articles disclosed in the prior art thus have the problems that the absorption speed is very low and the absorbent element is relatively stiff due to the excessive compression, though most of the liquid is not returned.

It is thus an object of the present invention to provide an absorbent article having a high rate of liquid absorption which is not excessively stiff and

does not tend to return the liquid.

According to the present invention there is provided an D7C absorbent article comprising a liquid permeable-inner sheet, a liquid-impermeable outer sheet and an absorbent element interposed between them, the D7045 absorbent element comprising two layers of fibrous material, which preferably have different compression properties, the first absorbent layer close to the outer sheet having a higher density than the second absorbent layer close to the inner sheet, the first absorbent layer having a plurality of layers of cavities distributed over its entire thickness, the area occupied by the cavities amounting to 45 to 80% of the cross-sectional area. The absorbent element thus comprises two absorbent layers and these are preferably formed by using at least two kinds of fibrous material having different compression properties.

When the absorbent article in accordance with the present invention is used, liquid is rapidly absorbed into the second absorbent layer, which is of lower density, and the liquid in the second layer is then rapidly diffused and transferred into the firt absorbent layer due to the difference in the absorption velocities between the first and second absorbent layers. In the first absorbent layer in which a plurality of layers of cavities is formed, the absorbed liquid is rapidly and reliably diffused into and absorbed in the cavities. Thus even if the second absorbent layer is wet, liquid is rapidly transferred from the second absorbent layer into the first absorbent layer and the second absorbent layer can thus continue to absorb liquid.

The absorbent article in accordance with the present

invention thus has a high speed of absorption and has no substantial tendency to return absorbed liquid and is not excessively stiff.

Further features and details of the present invention will be apparent from the following description of a number of specific embodiments of absorbent article in accordance with the invention which is given by way of example with reference to Figures 1 to 4 of the accompanying drawings, in which:-

Figure 1 is an enlarged cross-sectional view of the absorbent element of the absorbent article of Example 1;
Figure 2 is a cross-sectional view of the absorbent article of Example 1;
Figure 3 is a graph showing the pore diameter distribution of sample 1, described below; and
Figure 4 is a graph showing the pore diameter distribution of sample 5, described below.

An embodiment of the present invention will be described with reference to a sanitary napkin comprising a liquid-permeable inner layer, a liquid-impermeable outer layer and an absorbent element interposed between them.

In this embodiment, as shown in Figures 1 and 2, the absorbent element 1 comprises a first absorbent layer 2 having a relatively high density and a second absorbent layer 3 having a relatively low density which together form a laminated structure, as shown in Figure 2. In the assembled absorbent article the first absorbent

layer 2 is adjacent the impermeable outer layer 5 and the second absorbent layer 3 is adjacent the permeable inner layer 6 which, in this embodiment, in fact extends around the entire article and thus also overlies the impermeable layer 5. The first absorbent layer 2 has numerous cavities 4 formed in the direction of its thickness.

Non-water-absorbent synthetic fibres can be used as the second absorbent layer 3 so as to maintain the openings defined in the fibrous material constant. However, the wettability of such synthetic fibres by the liquid is less than that of water-absorbent fibres and, therefore, the absorption rate is relatively low. On the other hand, although water-absorbent fibres have a high wettability by the liquid, when the absorbent fibres absorb water, their strength decreases and they become limp. The fibres therefore adhere to one another and cavities can not be formed between them and the absorption rate is reduced over time. Further, the wetted fibres tend to become clogged by a highly viscous liquid thereby prolonging the absorption time. On the other hand, the stiffness of absorbent cotton fibres increases when they absorb water and their cross-section becomes round so that cavities can be formed between them. Under these circumstances, absorbent cotton or rayon is preferably used as the absorbent fibrous material.

Absorbent cotton which has a particularly high wettability, rapidly absorbs the liquid. In order to keep the liquid absorption time constant, the initial size of the pores in the absorbent element formed from

the fibrous material must be maintained during use. From this point of view, the use of absorbent cotton is preferred, since the rigidity of each filament of the fibrous material is increased and the cross-section thereof becomes close to a perfect circle after absorption of the liquid. ["Sen'i Gakki-shi", Vol. 30, Nos.5 and 6 (1974) and Vol. 39, No.10 (1983)]. Having regard to these unique properties, the use of absorbent cotton is most desirable, since the pores in the fibrous material are maintained unchanged and the absorbent properties thereof are not impaired.

The first absorbent layer 2 preferably comprises a pulp material. It has layers of cavities 4 between the compressed pulp layers in the thickness direction, as shown in Figure 1. The pulp material is preferably so called Kraft pulp which is fibrous and is produced by chopping timber into chips and then cooking them in a solution of sodium hydroxide and sodium sulphide Kraft pulp is generally sold highly compressed in the form of a board or sheet and, when used for sanitary articles, is loosened to make it fluffy.

The thickness of the first absorbent layer 2 is preferably 7 mm or less and the density thereof is 0.1 to 0.5 g/cm^3.

To obtain the maximum capacity of the absorbent article, the cavities 4 observed in the section of the compressed pulp layer must occupy 45 to 80%, preferably 55 to 70% of the cross-section of the compressed pulp layers. The term "cavity" as used herein indicates an opening formed between the layers which are 20 to 400μm

distant from each other in the preferred embodiment. The cavities occupy 45 to 80% per square millimetre of the cross-section of any arbitrarily selected portion of the first absorbent layer. The reason why the volume of the cavities is limited to 45 to 80% is that, when it is less than 45%, the absorbent element becomes so stiff as to make wearing the absorbent article uncomfortable to the user and, when it exceeds 80%, there is an inadequate difference in density between the first and second layers and the liquid is not absorbed but returned to a large extent though it does not make use of the article unpleasant.

As regards the pore diameter distribution of the cavities of the first layer 2, which was determined with a mercury porosimeter, the modal size of the cavities should desirably be 80 to 180μm, preferably 100 to 160μm. Modal diameter is the size of the most frequently occurring pore size. When the modal size is less than 80μm, the distance between the filaments is too small and the absorption rate is too low and the absorbent article is so stiff as to make use of it impracticable. On the other hand, when it exceeds 180μm, a reduction in the return of the liquid, which is a feature of the absorbent element of the present invention, is impossible. As mentioned above, the size of the cavities is measured with a mercury porosimeter and when discussing their size and distribution the cavities in the first layer 2 are referred to herein as pores.

It is preferred that the pore diameter distribution curve of the first layer has two peaks (maxima) or

shoulders, as shown in Figures 3 and 4. The ratio of the height of the peak (B) at the smaller pore diameter to that of the peak (A) at the larger pore diameter (i.e. B/A) should be below 1, preferably 0.9 to 0.7. When the peak height ratio is 1 or above, the volume of the pores having a small diameter is large and this reduces the absorption velocity and makes the absorbent element stiff. On the other hand, when the peak height ratio is below 0.7, the two peaks reflecting the layer structure cannot be obtained and there is no significant difference from ordinary absorbent elements. The ratio of the base weight of the absorbent cotton or rayon layer, which has a structure suitable for contact with the skin of the user, to that of the pulp layer is 0.2 to 2, preferably 0.8 to 1.5, from the standpoint of the absorption velocity, the reduction in the quantity of returned liquid under a load and the comfort of the user wearing the article.

By forming the cavities 4 in the first absorbent layer 2, the cavities 4 absorb liquid once it has been absorbed in the second absorbent layer 3 and this accelerates the diffusion of the liquid and its absorption, increases the quantity of liquid absorbed, prevents the return of the liquid and softens the first absorbent layer 2.

Although the absorbent article of the present invention is capable of exhibiting superior performance without using a known super absorbent polymer powder, the performance can be further increased by homogeneously mixing such powder into, or placing it at the periphery of, the absorbent element.

The first absorbent layer 2 having cavities 4 can be prepared as follows: a sheet comprising a pulverised pulp is first compressed by any known method with a hot roller or the like and then wound round a roller having a relatively small diameter of, for example, 15 mm in one direction to cause ply separation in the pulp layer. Then it is wound again in the opposite direction to form clear cavities 4 between the plies.

The function of this embodiment of the present invention is as follows:- liquid, such as menstrual blood, passing through the liquid-permeable outer layer 6 is first absorbed in the second absorbent layer 3 (absorbent cotton layer). The absorbent cotton layer has an excellent wettability and the distance between the filaments of the fibres thereof and the absorption velocity are not reduced with time.

The liquid absorbed in the second absorbent layer 3 is rapidly transferred into the first absorbent layer 2 (pulp layer) and then rapidly diffused or transferred into, and retained in, the cavities 4. Since the liquid is thus rapidly transferred from the second absorbent layer 3, the absorbent capacity of the layer 3 is not lost, even in the wet state, and the return of the liquid is inhibited.

The equivalent effect can of course be obtained even if the material of the first absorbent layer is the same as that of the second absorbent layer.

The following Examples illustrate the results of

experiments on absorbent articles in accordance with the present invention as compared with those in the comparative Examples. The materials used in the absorbent elements of the absorbent articles of the Examples and Comparative Examples will firstly be described.

Sample 1

A pulp sheet (NBF; a product of Weyerhauser Company) was pulverised on a hammer mill, piled in a base weight of 200 g/m^2, compressed on a miniembossing machine at 150°C under a linear pressure of 2 kg/mm, and wound round a roller having a diameter of 15 mm to cause ply separation in the pulp sheet. Then the pulp sheet was turned inside out and wound round the roller in the same manner as that described above to make the boundaries between the plies clearer. This procedure was repeated twice. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 1.

Sample 2

Absorbent cotton (Hakujuji J: absorbent cotton in accordance with the Japanese pharmacopeia) was piled in a base weight of 100 g/m^2 and an absorbent cotton sheet was prepared therefrom on the miniembossing machine under the same conditions as those of Sample 1. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 2.

Sample 3

A pulp sheet, which was the same as that used in Sample 1, was pulverised on a hammer mill, piled in a base

weight of 200 g/m^2, compressed on a miniembossing machine at 150°C under a pressure of 2 kg/mm, and wound round a roller having a diameter of 15 mm to cause ply separation in the pulp sheet. Then the pulp sheet was turned inside out and wound round the roller in the same manner as that described above to make the boundaries between the plies clearer. This procedure was repeated three times. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 3.

Sample 4

A pulp sheet, which was the same as that used in Sample 1, was pulverised on a hammer mill, piled in a base weight of 200 g/m^2, compressed on a miniembossing machine at 150°C under a pressure of 2 kg/mm, and wound round a roller having a diameter of 15 mm to cause ply separation in the pulp sheet. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 4.

Sample 5

A pulp sheet, which was the same as that used in Sample 1, was pulverised on a hammer mill, piled in a base weight of 200 g/m^2, and compressed on a miniembossing machine as 150°C under a pressure of 2 kg/mm. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 5.

Sample 6

A pulp sheet, which was the same as that used in Sample 1, was pulverised on a hammer mill and piled in a base

weight of 200 g/m^2. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 6.

Sample 7

Fluffy rayon (2d; a product of Daiwa Spinning Co., Ltd.) was piled in a base weight of 100 g/m^2 and treated on the miniembossing machine under the same conditions as those of Sample 1 to form a fluffy rayon sheet. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 7.

Sample 8

PET (2d; a product of Teijin Limited) which had been made hydrophilic and had a base weight of 100 g/m^2 was piled and treated on the miniembossing machine under the same conditions as those of Sample 1 to form a PET sheet. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 8.

Sample 9

A product was prepared from an absorbent cotton sheet having a base weight of 10 g/m^2 under the same conditions as those of Sample 2. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 9.

Sample 10

A product was prepared from an absorbent cotton sheet having a base weight of 20 g/m^2 under the same conditions as those of Sample 2. The resulting product

was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 10.

Sample 11
A product was prepared from an absorbent cotton sheet having a base weight of 200 g/m^2 under the same conditions as those of Sample 2. The resulting sample was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 11.

Sample 12
A product was prepared from an absorbent cotton sheet having a base weight of 300 g/m^2 under the same conditions as those of Sample 2. The resulting product was cut into pieces having a size of 200 mm long x 70 mm wide, which will be referred to as Sample 12.

Samples 1,3,4,5 and 6 were subjected to experiments for evaluating their properties, which will be described below. The results are given in Table 1 below.

Experiment 1: determination of pore diameter distribution

The pore diameter distribution was determined by using a cell having a volume of 5 ml on a Pore sizer, or porosimeter, 9310 (manufactured by Shimadzu Corporation). The pore diameter distribution was determined according to the volume average.

The modal diameter indicates the maximum peak value in the distribution.
Experiment 2: determination of void ratio

The term "void ratio" herein refers to the percentage of cavities per unit area of the cross-section. The respective layers of the cavities are 20 to 400 μm distant from each other.

Electron photomicrographs (SEM) at X50 magnification were taken. Four frames of 500 X 500 μm size were made at random and the area of the cavities in each frame was measured to calculate the void ratio per square millimetre.

Table 1

Result of evaluation of Samples

		Void ratio %	Peak Height ratio determined by the porosimeter	Modal diameter (μm)
Sample No.	1	68	0.87	144
	3	84	0.76	162
	4	43	0.97	82
	5	30	1.97	17
	6	94	-	300

Sample 6 had only one peak or shoulder.
Height ratio determined by the porosimeter = peak height of smaller pore diameter/peak height of larger pore diameter

The pore distribution of Sample 1 is shown in Figure 3 and that of the Sample 5 is shown in Figure 4. It will be apparent from these figures that the quantity of cavities having a relatively large diameter is larger than that of the cavities having a smaller diameter in Sample 1 and that the quantity of cavities having a relatively large diameter is smaller than that of the cavities having a smaller diameter in Sample 5.

The absorbent articles of the Examples and the Comparative Examples were prepared by suitably combining the Samples 1 to 12 as will be described below. In each case, the inner sheet was of a material as is used for sanitary napkins (Trade Name: Freeday) manufactured by Kao Corporation.

Example 1
Sample 2 was put on Sample 1 to form a laminar absorbent element, which was put on a polyethylene film having a thickness of 20 μm as the outer sheet. The inner sheet of material extended over the entire assembly.

Example 2
Sample 2 was put on Sample 3 to form a laminar absorbent element, which was put on a polyethylene film having a thickness of 20 μm as the outer sheet. The sheet of inner material extended over the entire assembly.

Example 3
Sample 2 was put on Sample 4 to form a laminar absorbent element, which was put on a polyethylene film

having a thickness of 20 μm as the outer sheet. The assembly was covered with a sheet of permeable material to obtain an absorbent article.

Example 4

Sample 9 was put on Sample 1 to form a laminar absorbent element, which was put on a polyethylene film having a thickness of 20 μm as the outer sheet. The assembly was covered with a sheet of permeable material to obtain an absorbent article, which was evaluated by Experiments 3 and 4, described below. The spreading ratio of the first absorbent layer to the second absorbent layer was determined after removing the inner sheet. The quantity of the returned liquid was determined in the absorbent article and in the absorbent element alone.

Example 5

Sample 10 was put on Sample 1 to form a laminar absorbent element, which was evaluated in the same manner as Example 4.

Example 6

Sample 11 was put on Sample 1 to form a laminar absorbent element, which was evaluated in the same manner as Example 4.

Example 7

Sample 12 was put on Sample 1 to form a laminar absorbent element, which was evaluated in the same manner as Example 4.

Example 8

Sample 7 was put on Sample 1 to form a laminar absorbent element, which was evaluated in the same manner as Example 4.

Example 9

Sample 8 was put on Sample 1 to form a laminar absorbent element, which was evaluated in the same manner as Example 4.

Comparative Example 1

Sample 2 was put on Sample 5 to form a laminar absorbent element, which was put on a polyethylene film having a thickness of 20 μm as the outer sheet. The assembly was covered with a sheet of permeable material to obtain an absorbent article.

Comparative Example 2

Sample 2 was put on Sample 6 to form a laminar absorbent element, which was put on a polyethylene film having a thickness of 20 μm as the outer sheet. The assembly was covered with a sheet of permeable material to obtain an absorbent article.

The absorbent articles prepared in the above Examples and Comparative Examples were subjected to the following experiments:

Experiment 3: Experiment on absorption time and diffusion area

6 g of physiological saline was injected into the absorbent element and the injection time and spread area thereof in each layer was determined. The injection was conducted by placing a cylinder having an

inner diameter of 2 cm on an acrylic plate having a hole with a diameter of 1 cm and pouring the test liquid thereinto to let the sample absorb it.

Experiment 4: Experiment on liquid return rate

The injection was conducted under the same conditions as those of the Experiment 1. 10 sheets of filter paper were put on to the absorbent element and a pressure of 50 g/cm^2 was applied thereto for 5 min. The pressure was released and the quantity of the liquid absorbed by the filter paper was determined. The liquid return rate was then calculated from the following formula (numeral formula 1):

$$\text{Liquid return rate (\%)} = \frac{\text{quantity of liquid absorbed by filter paper (g)}}{\text{quantity of injected liquid (g)}} \times 100$$

The results obtained in the Experiments 3 and 4 are given in Table 2.

Table 2

Sample		Absorption time for 6 g of test liquid (sec)	Liquid return rate (%)	Softness
Ex. No.	1	5	0.03	○
	2	4	0.04	◎
	3	6	0.06	○~△
Comp. Ex. No.	1	9	0.08	x
	2	2	0.36	◎

It will be apparent from this table that the absorbent article prepared in Example 1 absorbed the liquid more rapidly than the articles of the Comparative Examples.

The absorbent articles prepared in Examples 1,4,5,6 and 7 were subjected to Experiments 3 and 4 and further the spreading ratio of the liquid in the first layer to that in the second layer and the softness of the articles, when worn, were also examined. The results are given in Table 3.

Table 3

Sample No.		Base wt. of absorbent cotton (g/m^2)	Liquid return		Spreading ratio of the first layer to the second layer	Comfort, when worn	Thickness (mm)
			absorbent element	absorbent article			
	4	10	50	0.15	4.1	◎	1.9
Ex.No.	5	20	34	0.12	3.2	◎	3.5
	1	100	15	0.03	4.7	◎	5.4
	6	200	13	0.04	5.4	○~△	6.8
	7	300	25	0.08	5.9	x	9.7

The comfort, when worn, of the absorbent articles was evaluated by replacing the absorbent element of a Freeday sanitary napkin (a product of Kao Corporation) with that of Example 1,4,5,6 or 7 and having five subjects wear and evaluate each article. The results of the evaluation were classified as follows:

ⓒ	:	the absorbent article was soft and comfortable to wear,
○	:	the absorbent article was usable, though it was somewhat uncomfortable,
△	:	the absorbent article was somewhat uncomfortable and some of the subjects accepted it but others did not, and
x	:	the absorbent article could not be used because it was too uncomfortable.

It will be apparent from Table 3 that the absorbent element and the absorbent article of each Example in which absorbent cotton was used as the second absorbent layer exhibited a low liquid return rate.

The spreading ratio of the liquid in the first layer to that in the second layer, the liqid return rate (in the absorbent element and the absorbent article) and comfort, when worn, of Examples 8 and 9 were evaluated by the experiments described above. The results are given in Table 4.

Table 4

Sample	Spreading ratio of the first layer to the second layer	Liquid return rate (%)		Comfort, when worn	Thickness (mm)
		absorbent element	absorbent article		
Ex. 8	3.3	28	0.08	◎	6.6
Ex. 9	4.9	33	0.18	○～△	9.8

It will be apparent from this table that the absorbent articles of the Examples of the present invention have a reduced liquid return rate. Further they are comfortable to wear.

CLAIMS

1. An absorbent article comprising a liquid-permeable inner sheet, a liquid-impermeable outer sheet and an absorbent element interposed between them, the absorbent element comprising two layers of fibrous material, the first absorbent layer close to the outer sheet having a higher density than the second absorbent layer close to the inner sheet, the first absorbent layer having a plurality of layers of cavities distributed over its entire thickness, the area occupied by the cavities amounting to 45 to 80% of the cross-sectional area.

2. An article as claimed in claim 1, wherein the layers of cavities in the first absorbent layer are spaced apart by 20 to 400 μm.

3. An article as claimed in claim 1 or 2 in which the graph of diameter against frequency of the pores in the cavities of the first absorbent layer, as determined with a mercury porosimeter, has two peaks, the ratio of the height of the peak of the smaller pore diameter to that of the peak of the larger pore diameter being 1 or below and the most frequent diameter of the cavities being 80 to 180 μm.

4. An article as claimed in any one of claims 1 to 3, in which the ratio of the base weight of the first absorbent layer to that of the second absorbent layer is 0.1 to 1.

5. An article as claimed in any one of claims 1 to 4, in which the ratio of the diffusion area of the first absorbent layer to that of the second absorbent layer (as herein defined) is at least 3 and the return rate (as herein defined) of an injected test liquid under a pressure of 50 g/cm^2 is 35% or below.

6. An article as claimed in any one of claims 1 to 5, in which the first absorbent layer comprises fluffy pulp.

7. An article as claimed in any one of claims 1 to 6, in which the second absorbent layer comprises absorbent cotton.

8. An article as claimed in any one of claims 1 to 6, in which the second absorbent layer of the absorbent element comprises rayon.

Patents Act 1977

Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9206761.0

Relevant Technical fields

(i) UK Cl (Edition K) A5R (RPG), (RPL), (RPR)

(ii) Int CL (Edition 5) A61F

Search Examiner

R J WALKER

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

22 MAY 1992

Documents considered relevant following a search in respect of claims 1-8

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2208477 A (KIMBERLEY-CLARK CORPORATION) See eg Claim 1	1
A	GB 2165757 A (KIMBERLEY-CLARK CORPORATION) See eg Claim 1	1

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: ______________________

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.